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MATHEMATICS

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Module 5

STATISTICS



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MATHEMATICS

24



Module 5
STATISTICS

Mathematics 24
Module 5: Statistics
Student Module Booklet
Learning Technologies Branch
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This document is intended for	
Students	✓
Teachers	✓
Administrators	
Home Instructors	
General Public	
Other	



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- Alberta Learning, <http://www.learning.gov.ab.ca>
- Learning Technologies Branch, <http://www.learning.gov.ab.ca/lfb>
- Learning Resources Centre, <http://www.lrc.learning.gov.ab.ca>

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Welcome to **MATHEMATICS**

24

Module Five

Mathematics 24 contains six modules. You should work through the modules in order (from 1 to 6) because concepts and skills introduced in one module will be reinforced, extended, and applied in later modules.

Module 1 INDEPENDENT LIVING

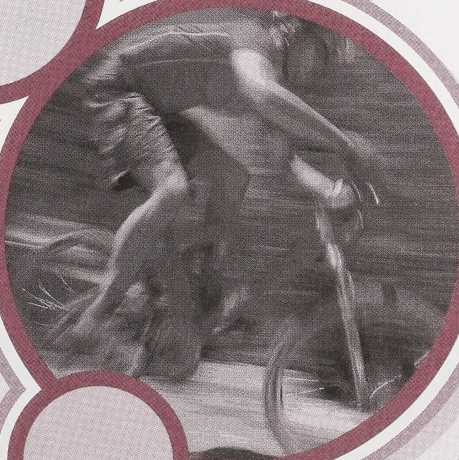
Module 2 WHEELS

Module 3 APPLYING GEOMETRY

Module 4 MAPS, DATA, and PROBABILITY

Module 5 STATISTICS

Module 6 DESIGN and CONSTRUCTION



Module 1 contains general information about the course components, required resources, visual cues, assessment and feedback, and strategies for completing your work. If you do not have access to Module 1, contact your teacher to obtain this important information.

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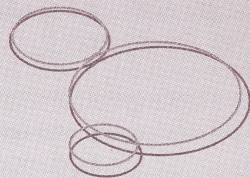
6 Module Overview

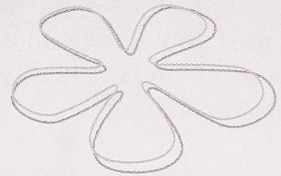
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MODULE OVERVIEW

Hot looks for making a big entrance at grad / **Fashion E1**

Flames one win away from Finals / **Sports D1**

CALGARY REVIEW

Tuesday, May 18, 2004

Sixty Percent of Homeowners Support Proposed Cat Bylaw

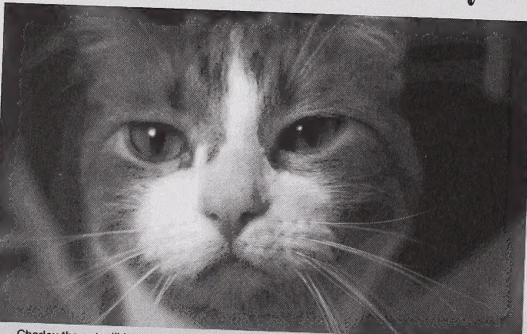
No More Roaming Around

DAVID QUICK
Review Staff Writer
Calgary

City cats will no longer be free to roam the streets of Calgary if residents get their way. Sixty percent of Calgarians polled support the bylaw which was introduced by Alderman Sydney Fallon on Friday.

"It's not that I hate cats," said Fallon, "I just don't think they should be wandering throughout our communities unchecked."

Fallon acknowledges that the majority of Calgary's cat owners are very responsible in keeping tabs on the whereabouts of their pets, but admits that it is the "neglectful few" who are contributing to the problem and making a need for a bylaw which restricts the movements



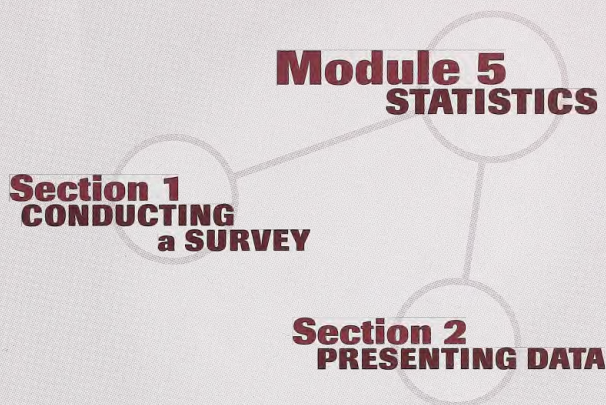
Charley the cat will have to get used to walking on a leash if city lawmakers get their way.

Have you ever taken part in an opinion survey? Governments and businesses often survey the people they serve. Surveys let them get peoples' views and better meet their needs.

Political parties also do surveys, especially before elections. They want to know how they are perceived and how their support may be changing.

Have you wondered how accurate these surveys are? Do you know how the polling companies select the people they survey, how they pose the questions they ask, and how they present their data? These are key questions in the branch of mathematics called *statistics*.

In this module you will look at survey methods and how data is gathered, analyzed, and presented. You will explore issues of honesty and accuracy in presenting results. When you complete this module, you will have the tools you need to comment on survey results found in the media.



Your mark on this module will be determined by how well you complete the two Assignment Booklets.

The suggested mark distribution is as follows. Be sure to check with your teacher if this mark allocation is valid for you. Some teachers like to include other reviews and assignments.

Assignment Booklet 5A

Section 1 Assignment	50 marks
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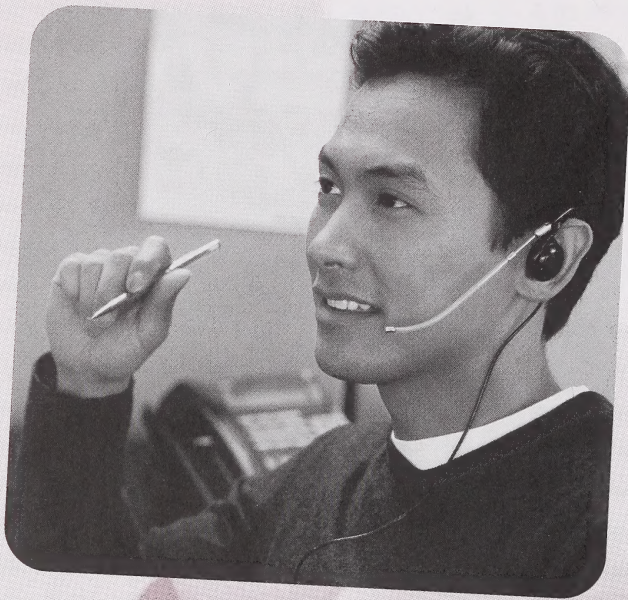
Assignment Booklet 5B

Section 2 Assignment	30 marks
Final Module Assignment	20 marks
Total	100 marks

When doing the assignments, work slowly and carefully. Be sure you attempt each part of the assignments. If you are having difficulty, you may use your course materials to help you, but you must do the assignments by yourself.

You will submit Assignment Booklet 5A to your teacher before you begin Section 2. You will submit Assignment Booklet 5B to your teacher at the end of this module.

SECTION 1



Conducting a Survey

Rem has been hired by an independent survey company to gather and report on opinions about an upcoming civic election. How will he complete this task? Will he interview residents? What questions will he ask? How will he select the people he surveys? How well will his report represent the voters' opinions?

Section 1 focuses on these kinds of questions. You will explore how surveys are conducted and you will critique a variety of survey techniques. You will discuss issues surrounding survey techniques, such as bias, accuracy, and survey questioning. You will find that considerable planning has to precede a survey. You will also see that some surveys take the form of scientific experiments. They gather information that simple questions cannot obtain, such as, what is your reaction time to a loud noise?

LESSON 1

Sampling Techniques

In this lesson you will explore collecting information about a population through surveys.



Amber is on the students' council at Mountainview High School. The school has 300 students. The town of Mountainview needs volunteers to plant trees in a park on Saturday, June 12. The town has asked the students' council if the student body would be willing to help.

Amber suggested that the students' council **survey** 50 students. This would show what level of support this idea has among students.

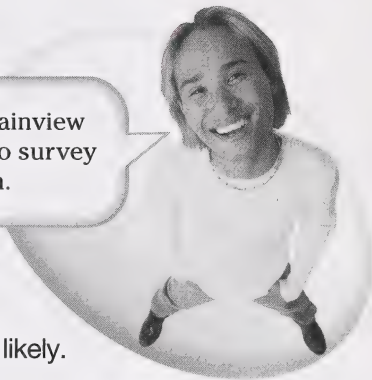
How should the council select the students to be surveyed? It is important to get opinions that are representative of the entire school population.

Questions like this are the domain of **statistics**. Statistics is the branch of mathematics that deals with

- planning and conducting experiments to gather information
- analyzing and presenting this information
- making decisions based on information gathered

The word *statistics* comes from the Latin word *status*, which means “state” or “condition.” The origins of statistics can be traced to the Roman census. The Roman census was conducted to gather information about the status of the empire. In statistics, a census means the process of collecting data from everyone in a particular **population**. It may be impossible or costly to survey everyone; instead, only part of a population, or a **sample**, is surveyed.

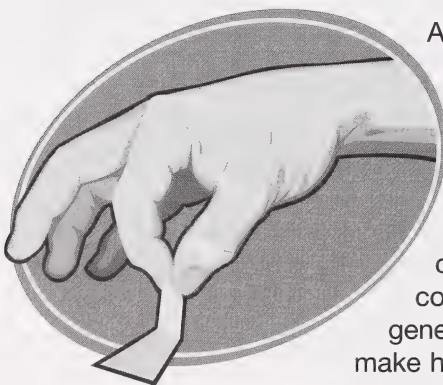
The population is all 300 students at Mountainview High School. The 50 students Amber wants to survey are a sample of the school population.



You can't be absolutely certain that a sample will represent a population's viewpoint; however, certain ways of picking the sample make it more likely.

Random Sampling

To select the 50 students for the survey, Amber could use simple **random sampling**. In simple random sampling, each member of the population has an equal chance of being chosen.



Amber could get all 300 students to write their names on slips of paper. She could then put these slips of paper in a container and mix them thoroughly. Then she could draw 50 names at random.

Instead of using slips of paper, Amber could also use a numbered student list. She could have a computer or calculator randomly generate 50 numbers between 1 and 300 to make her selection.

Clustered Sampling

Another sampling technique is **clustered sampling**. Suppose that all students have first-period classes. Also suppose that there are about 25 students in each class. Amber could randomly select two classes to survey. All the students in both classes, about 50 altogether, would participate in the survey.

Stratified Sampling

Neither random sampling nor clustered sampling guarantees that each grade in the school is fairly represented.

To represent each grade fairly, Amber would have to pick students randomly from each grade, but she would have to choose them in the right proportion too.



For example, if 40% of the students were in grade 10, she would choose 40% of 50 = $0.40 \times 50 = 20$ students from grade 10.

If 30% of the students were in grade 11, Amber would randomly select 30% of 50 = $0.30 \times 50 = 15$ students from grade 11.

The last 30% would be grade 12 students, so Amber would randomly select 30% of 50 = $0.30 \times 50 = 15$ students from grade 12.

Amber's sample would still contain $20 + 15 + 15 = 50$ students. This technique is an example of **stratified sampling**. Stratified sampling ensures that various groups within the population are fairly represented.

Convenience Sampling

One sampling technique that does not involve random selection is **convenience sampling**. Amber and other council members could stand near the school entrance in the morning and ask 50 students for their opinion as they arrive at school. Here the sample is drawn for the convenience of the surveyors.

Self-Selected Sampling

A second non-random method is **self-selected sampling**. Amber could make it known that 50 students are needed to fill in a questionnaire. Students could then decide on their own (that is, select themselves) whether or not to take part.

1. State reasons why convenience sampling or self-selected sampling might not provide Amber and the students' council with samples that represent the opinion of the entire school.

Check your answer on page 45 in the Appendix.

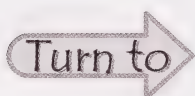


Turn to pages 276 to 279 in your textbook and read "Tutorial One: Sampling Populations."

2. Turn to pages 279 and 280 in your textbook. Do questions 1 to 4 of "Put into Practice."

Check your answers on pages 45 to 47 in the Appendix.

In this lesson you explored sampling techniques and were introduced to some of the issues and vocabulary in statistics.



the Section 1 Assignment in Assignment Booklet 5A.
Answer question 1.



LESSON 2

Designing Questionnaires

In this lesson you will investigate what issues must be considered when designing and using questionnaires.



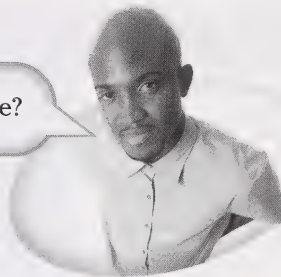
In Lesson 1 Amber wanted to survey students about planting trees in a town park. Selecting a sample of the school population to survey is an important part of the process. The larger the sample size is, the more likely it is the survey results will be accurate.

The students' council decided to collect information from their sample using a written questionnaire, which means there are a number of additional issues to be considered. The questionnaire must collect the data the council needs. That is, the survey must be **valid**. In addition, the survey must be **reliable** (that is, using different students would give similar results). If a survey is not valid and reliable, the survey is flawed. This type of survey would be **biased**.

Questionnaires are easy to give and easy to analyze. Also, people can complete them at their own speed and on their own time. People are less intimidated by a written survey than they are by a face-to-face interview.

There are also disadvantages to using a written questionnaire. Even short, simple ones are often ignored or forgotten and are not completed. People completing a questionnaire have no opportunity to ask any questions they may have about the questionnaire. Also, the person may wish to add comments or explain his or her answers. Another problem is the person who is receiving the questionnaire may not be the one who actually completes it. It is also impossible to tell if the questionnaire was completed honestly.

How can you design an effective questionnaire?



Turn to pages 281 and 282 in your textbook. Read “Tutorial Two: Designing and Using an Effective Questionnaire” to the bottom of page 282.

1. Turn to page 283 in your textbook. Complete “Investigation: Looking at a Questionnaire.”

Check your answer on page 47 in the Appendix.



In the previous investigation, you encountered a variety of issues surrounding surveys and how to avoid bias. Next, you will look at how to prepare good questions for a questionnaire.

There are two different kinds of questions that can be used on questionnaires—**open questions** and **closed questions**.

Open questions are questions that require respondents to answer in their own words or to fill in a blank.

Following are some examples of open questions:

- How many hours a week do you spend doing homework?
- What do you think the advantages of a four-day work week are?

Closed questions are questions that force respondents to make a choice.

Following are some examples of closed questions:

- Do you receive a daily newspaper? Circle your response.

yes no

- Do you do your homework? Circle your response.

A. always B. usually C. seldom D. never

- Rank the following issues from most important to least important. Use 1 for most important and 5 for least important.

_____ military spending	_____ health care
_____ environment	_____ education
_____ employment	

- What kinds of magazines do you read? Check all that apply.

_____ news	_____ sports
_____ travel	_____ lifestyle
_____ auto	_____ entertainment
_____ other	

You will have to decide on closed or open questions for your questionnaire. You also need to write an introduction that explains the purpose of the survey. Next, plan your questions carefully. Following are several guidelines.



- Keep the language simple and add information to clarify the question.

Poor: Is your support for the cat bylaw categorical? Circle your response.

yes no

Better: Town council is introducing a bylaw to restrict cats to their owners' properties. Do you support this cat bylaw? Circle your response.

yes no

- Do not word the question to favour one response over another.

Poor: Mosquitoes are known to carry several serious diseases, such as malaria and West Nile. Should the town spray to control mosquitoes? Circle your response.

yes no

Better: Should the town spray to control mosquitoes? Circle your response.

yes no undecided



- Only ask for one thing in each question.

Poor: Do you like the shape and taste of Mega-Pop Novelty Popcorn? Circle your response.

yes no

Better: Do you like the shape of Mega-Pop Novelty Popcorn? Circle your response.

yes no

Do you like the taste of Mega-Pop Novelty Popcorn? Circle your response.

yes no

- Do not insult or unfairly criticize a group or culture.

Poor: Many knowledgeable hockey fans consider the views of the Anti Red-Line League off the wall. Do you support their proposal to eliminate the red line in professional hockey? Circle your response.

yes no

Better: Do you support the Anti Red-Line League's proposal to eliminate the red line in professional hockey? Circle your response.

yes no

- Provide for a variety of responses.

Poor: On average, how many hours do you spend watching television on a school night? Circle your response.

A. 0 to 3 hours B. over 3 hours

Better: On average, how many hours do you spend watching television on a school night? Circle your response.

A. none B. under 1 hour C. 1 to 2 hours
D. 2 to 3 hours E. over 3 hours

You need to ensure that all answers are kept private.
If a person's answers are likely to become general knowledge, they are less likely to answer honestly, if they answer at all.



Now it's time to apply these principles.

2. Turn to pages 284 to 286 in your textbook. Complete the following investigations.
 - a. "Investigation 2: Looking at a Survey," questions 1 to 7
 - b. "Investigation 3: Looking at a Questionnaire"
3. Turn to page 287 in your textbook. Do questions 1 and 3 of "Put into Practice."

Check your answers on pages 47 to 49 in the Appendix.



4. Rewrite the following questions to avoid bias.

a. Do you have a cat or a dog as a pet? Circle your response.

yes no

b. Are you happy with your current computer? Circle your response.

yes no

c. Where do you live? Circle your response.

A. Alberta

B. Western Canada

C. Northwest Territories

D. Other

d. Don't you agree that politicians are paid too much? Circle your response.

yes no

e. How would you rank the novel *The Leopard's Pause*? Circle your response.

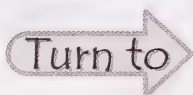
A. wonderful

B. awful

5. Reread the introduction to this lesson. Prepare a written questionnaire to help the students' council survey school opinion about the tree-planting proposal.

Check your answers on pages 49 and 50 in the Appendix.

In this lesson you explored written questionnaires as a method of collecting survey data. You also considered issues of bias, validity, and reliability.



the Section 1 Assignment in Assignment Booklet 5A.
Answer question 2.


LESSON 3

Interviews

In this lesson you will examine the use of interviews to collect survey information.



Every five years in Canada, information is collected about Canadians through a national census. Most Canadian households receive questionnaires they must complete and return to Statistics Canada. However, about 2% of the population is surveyed through an interview. Interviews are often used for residents in remote areas and in the downtown areas of large cities. Interviews can be conducted in person or by telephone.



If you have access to the Internet and want to find out more about the Canadian census and how census information is gathered, visit the Statistics Canada website:

<http://www.statcan.ca/>

Gathering census and survey information is more expensive when an interview is used. However, interviews offer several advantages over questionnaires:

- The interviewer can ask more difficult questions that may require an explanation.
- Information can be obtained through the subject's behaviour and body language.
- Interviews may help overcome reading difficulties and some language problems.
- The interviewer can ask follow-up questions to clarify a response or to probe more deeply.
- The interviewer can establish trust with the person being interviewed to get a more honest or open response.
- The response rate to questions in an interview is much higher than it would be on a written questionnaire.

There are also disadvantages with interviews:

- Interviews are expensive.
- The interviewer may add bias to the results by not asking the questions consistently.
- The subject may dislike the interviewer and not respond openly.
- It may be difficult to analyze verbal responses.

1. List some other advantages and disadvantages of using an interview.

Check your answer on page 50 in the Appendix.



Turn to page 288 in your textbook. Read the information and study “Example 1: Interview Questions.”

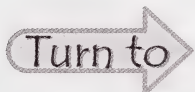
2. Turn to page 289 in your textbook. Complete “Investigation: Interview Questions.”



3. Turn to page 289 in your textbook. Do question 1 of “Put into Practice.”

Check your answers on page 51 in the Appendix.

In this lesson you explored collecting survey data with an interview. You examined some of the advantages and disadvantages of this approach.



the Section 1 Assignment in Assignment Booklet 5A. Answer questions 3, 4, and 5.

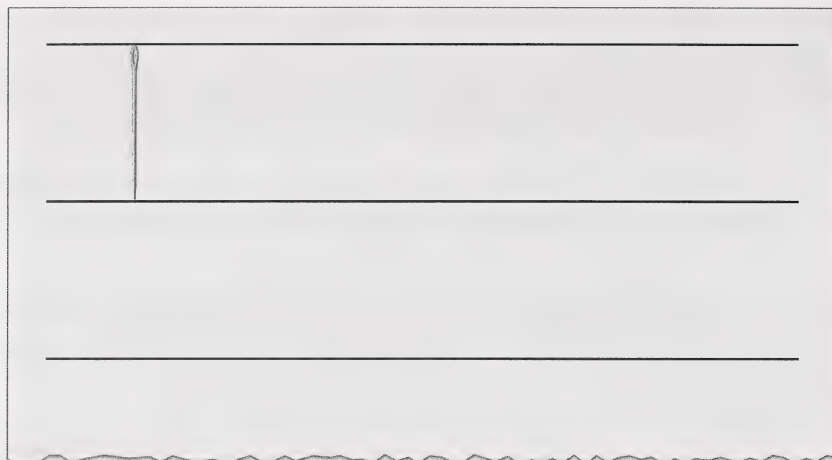
LESSON 4

Experiments

In this lesson you will explore how experiments can be used to gather data, to check conjectures, and to draw conclusions.

Moira and Jason are conducting an **experiment**. They read an article in a science journal that outlines how the number π can be estimated by dropping a needle on a ruled sheet of paper. The students decided to test this **conjecture**. On a large sheet of paper, they drew a series of parallel lines that are the same distance apart as the length of a needle.

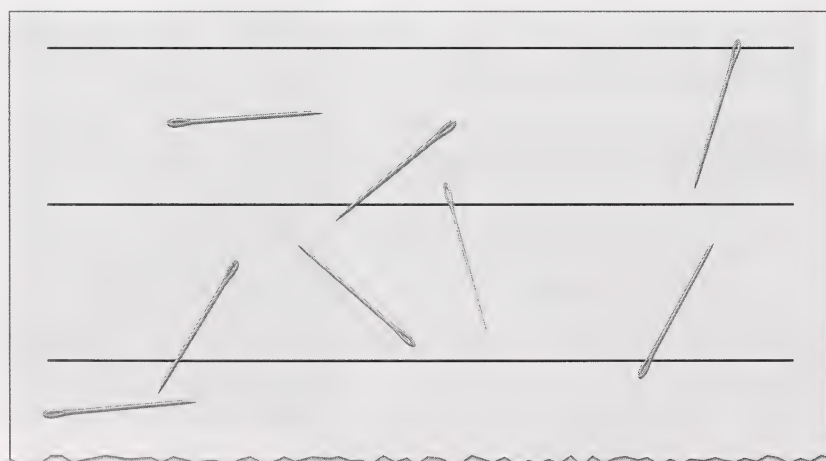




They placed the sheet of paper on a tabletop. From a height of about 30 cm, they repeatedly dropped the needle onto the sheet. They recorded their observations using a tally sheet.

Needle Comes to Rest on a Line	Needle Comes to Rest Between the Lines

When the needle came to rest on a line, they put a tally mark in the left column. When the needle came to rest without crossing a line, they put a tally mark in the right column. They repeated this process 200 times.



Conduct the experiment,
but only drop the needle
50 times.



1. What was the total number of times the needle landed on a line?
2. Divide the total number of tosses by the number of times the needle landed on a line.

$$\frac{\text{total number of tosses}}{\text{number of times the needle landed on a line}}$$

3. Multiply this fraction by 2.
4. Compare your answer with $\pi = 3.142\ 59\ .\ .\ .$
5. How do you think you could modify this experiment to get a better approximation of the value of π ?

Check your answers on page 52 in the Appendix.

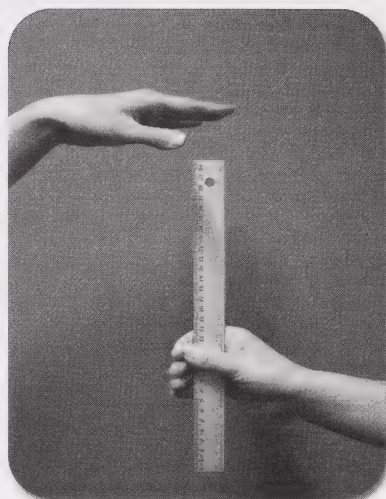
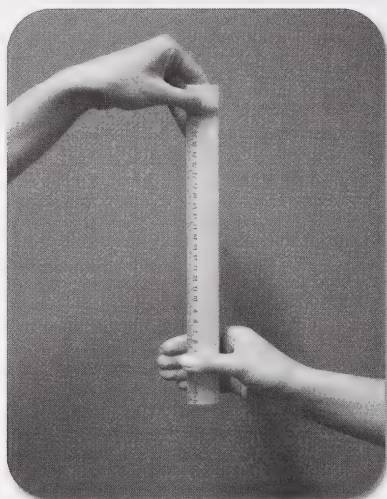
The needle experiment was first performed by Count Buffon, an eighteenth-century French scientist. If you have access to the Internet, you can find out more about his discovery at the following website:

<http://www.mste.uiuc.edu/reese/buffon/buffon.html>

Another simple experiment you can perform involves reaction times. Ask a friend to try to catch a ruler between his or her thumb and forefinger. Have your friend open these fingers just wide enough to let a ruler slip through them.

Place the ruler between your friend's open fingers at the 5-cm mark. Tell your friend to close his or her fingers as soon as you release the ruler. Record the distance (in centimetres) the ruler falls between the time you release the ruler and the time your friend catches it.

Repeat this experiment five times to get an average reading. Then repeat this experiment with a sample of 20 people you select.



6. What is the average distance the ruler falls for your sample of 20 people?
7. To convert the distance (d) the ruler falls into a reaction time (t) in seconds, use the following formula:
$$t = \sqrt{0.002 \times d}$$
8. What population does your sample represent?
9. How representative is this sample of your intended population?
10. How could you improve your sampling techniques to ensure the results are more reliable?

Check your answers on page 52 in the Appendix.

11. In what ways does the reaction-time experiment differ from the approximation-of- π experiment?

Check your answer on page 52 in the Appendix.

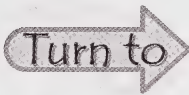
Your textbook outlines experiments you can perform to determine the physical fitness of a sample of people you choose. You will examine your sample results and draw conclusions about the population your sample represents.



12. Turn to pages 290 and 291 in your textbook. Read the introduction and do questions 1 to 6 of “Investigation: Heart Rate Experiment.”
13. Turn to page 292 in your textbook. Do question 1 of “Put into Practice.”

Check your answers on pages 53 and 54 in the Appendix.

In this lesson you gathered data from experiments. Some of the experiments you conducted involved people in samples you chose to represent specific populations. You analyzed your results to see how representative your samples were and how valid the experiments were in gathering data about what you wanted to measure.



the Section 1 Assignment in Assignment Booklet 5A. Answer questions 6 and 7.



CONCLUSION

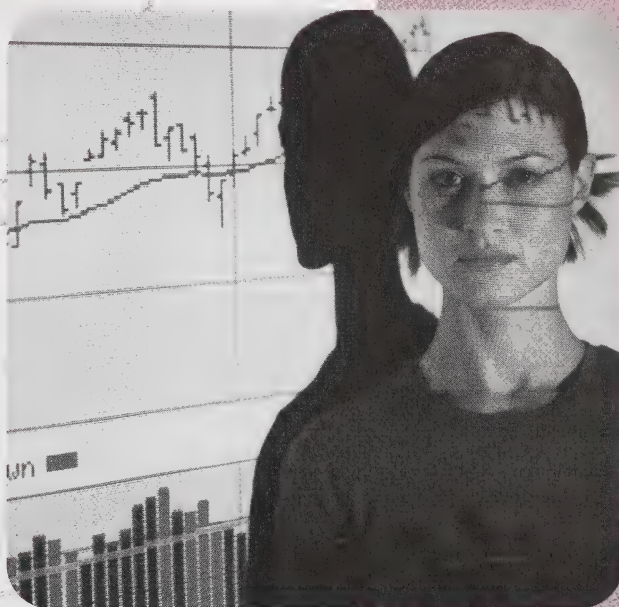
In this section you explored how surveys are conducted. You investigated a variety of random and non-random survey-sampling techniques. You looked at the issues of validity and reliability, analyzed written questionnaires, and reviewed techniques for collecting data through interviews. As well, you explored and designed experiments to collect data from survey samples.



The media—television, radio, magazines, and newspapers—are always probing public opinion. Knowing the public view can help the media cover issues their viewers, audience, or readers think are important. Also, knowing the public better will help them plan how to hold the public's interest and survive in a very competitive marketplace.

You may eventually have a career that involves the use of survey data directly. In the meantime, your daily life is still influenced by those who conduct surveys and interpret the data.

SECTION 2



Presenting Data

“A picture is worth a thousand words.” Have you ever heard this old saying? This is certainly true when presenting a report. If the main points can be put into a graph or table, it will be easier to understand. You will have a much easier time getting your points across. You will also have a better chance of having your recommendations accepted. Computer software can be used to design these tables and graphs in an eye-catching and professional format.

In this section you will use the power of graphs and tables to interpret, summarize, and present survey data. You will use spreadsheet software to help you design these graphs and tables. In addition, you will learn how to present your data honestly and effectively. You will critique those graphs and charts that are flawed and do not present their data in an open and straightforward fashion.

LESSON 1

Presenting Survey Results

In this lesson you will investigate different ways of presenting data and analyzing survey results.

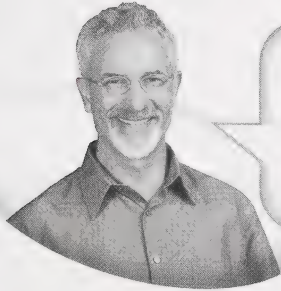


In the news release for a 2003 survey conducted by the polling company Ipsos-Reid, the headline stated “Six in Ten (58%) Canadians Plan on Taking a Vacation This Summer.”

This survey defined summer as the period between the Victoria Day holiday in May and Labour Day in September. The article revealed that these findings were based on a random sample of 1000 adults surveyed between May 6 and May 8, 2003, and the sample was weighted to reflect the actual composition of the Canadian population. As well, the article explained that, based on the size of this sample, the survey results (58%) could be considered accurate to within $\pm 3.1\%$, 19 times out of 20. In other words, the probability that the error in these results would exceed 3.1% is only one chance out of 20.

When you read survey results, look for the following elements:

- the purpose of the survey
- what questions were asked
- the size and composition of the survey sample
- how the sample was selected
- when the survey was conducted
- the accuracy (reliability) of the survey



In many instances, more than a simple yes-or-no question appears among survey reports. In these cases, the results can be shown effectively using graphs to support the written analysis.

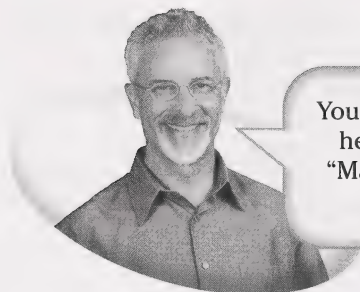
Example

Part of the poll about summer vacations asked those participating in the survey to choose a single destination from a list of exotic vacations.

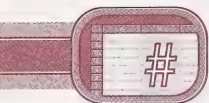
The following table is based on those survey results.

Exotic Vacation	Percentage of Canadian Choices
Hiking in Australian Outback	38%
Trekking Through Amazon Jungle	15%
Heli-skiing in Rockies	12%
Running with Bulls in Pamplona, Spain	10%
Climbing Mount Kilimanjaro	9%
None of These	11%
Don't Know	5%

Present these results on a bar graph using spreadsheet software.



You can either follow the steps shown here or work through the segment “Making Graphs with a Spreadsheet” on the multimedia CD.



Step 1: Open a new spreadsheet.

Step 2: Enter the data as shown below.

	A	B	C
1	Hiking in the Australian Outback	38	
2	Trekking Through the Amazon Jungle	15	
3	Heli-skiing in the Rockies	12	
4	Running with Bulls in Pamplona, Spain	10	
5	Climbing Mount Kilimanjaro	9	
6	None of These	11	
7	Don't Know	5	

Step 3: Highlight the data in columns A and B.

Step 4: Select the Chart Wizard from the tool bar.

Step 5: Select Column from the chart types and then click on the Next button.

Step 6: Select for series to be arranged in rows and click on the Next button. By selecting this option, a legend appears to identify the bars on the graph.

Step 7: Select the Legend tab and choose for the legend to be shown on the right.

Step 8: Select the Titles tab and enter the following titles for the graph and the axes:

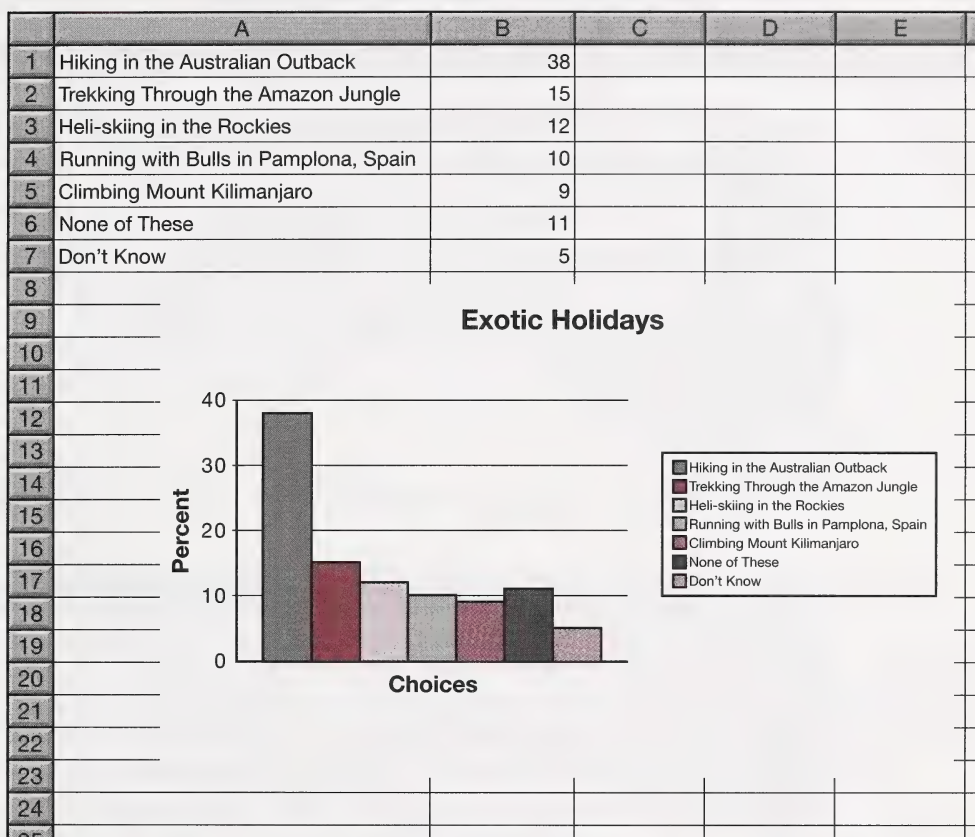
Chart Title: Exotic Holidays

Category (X) Axis: Choices

Category (Y) Axis: Percent

Then click on the Next button.

Step 9: Display the graph on your spreadsheet. It should look something like the one that follows.



The same information can be presented using a circle graph.

Step 1: Open a new spreadsheet.

Step 2: Enter the data as shown below.

	A	B	C
1	Hiking in the Australian Outback	38	
2	Trekking Through the Amazon Jungle	15	
3	Heli-skiing in the Rockies	12	
4	Running with Bulls in Pamplona, Spain	10	
5	Climbing Mount Kilimanjaro	9	
6	None of These	11	
7	Don't Know	5	

Step 3: Highlight the data in columns A and B.

Step 4: Select the Chart Wizard from the tool bar.

Step 5: Select Pie from the list of chart types. Click on the Next button.

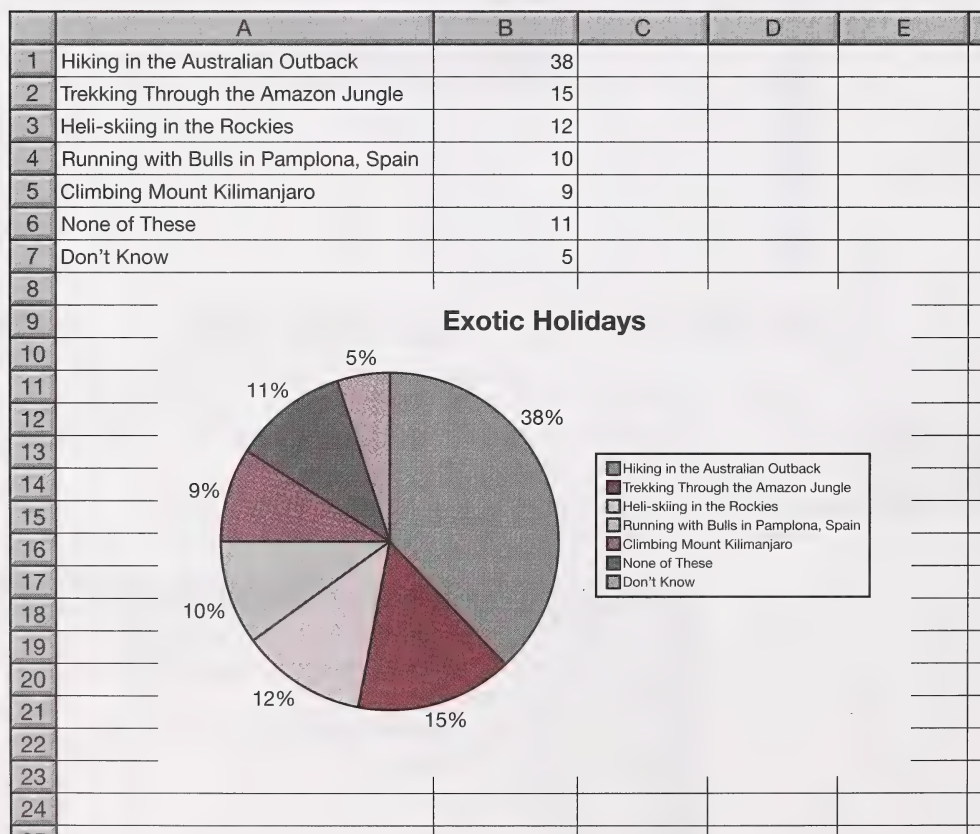
Step 6: Select to have series arranged in columns and click on the Next button.
By selecting this option, a legend appears to identify the sectors on the graph.

Step 7: Select the Titles tab and enter the following title for the graph:

Chart Title: Exotic Holidays

Step 8: From the Data Labels tab, select Show Percent and click on the Next button.

Step 9: Display the graph on your spreadsheet. Your graph should look like the one shown below.





1. Turn to pages 293 and 294 in your textbook. Read page 293 and complete “Investigation: Looking at Graphs” on page 294.

Check your answers on pages 54 and 55 in the Appendix.

In the next example you will create a double bar graph to compare two related sets of data.



Example

Marcel and Mei were both born in Alberta and are in the same mathematics class. They are working together on a statistics project dealing with first languages, or mother tongues. Marcel’s first language is French. Mei’s mother tongue is Chinese. From the 2001 census data on the Statistics Canada website (<http://www.statcan.ca>), they discovered that the top five first languages other than English in Alberta were Chinese, German, French, Ukrainian, and Punjabi. Then they compared the numbers of Albertans with the number of British Columbians who had these languages as their mother tongues. They summarized their findings in the following table.

	Alberta	British Columbia
Chinese	78 205	307 990
German	78 040	84 605
French	58 645	54 400
Ukrainian	33 970	13 600
Punjabi	22 535	121 740



Marcel and Mei decided to create a double bar graph using spreadsheet software.

Step 1: Open a new spreadsheet.

Step 2: Enter the data as shown below.

	A	B	C	
1		Alberta	British Columbia	
2	Chinese	78 205	307 990	
3	German	78 040	84 605	
4	French	58 645	54 400	
5	Ukrainian	33 970	13 600	
6	Punjabi	22 535	121 740	

Step 3: Highlight the data in columns A through C.

Step 4: Select the Chart Wizard from the tool bar.

Step 5: Select Column from the list of chart types and then click on the Next button.

Step 6: When Data Range is displayed, click on the Next button.

Step 7: Select the Titles tab and enter the following titles for the graph and the y-axis:

Chart Title: Mother Tongue

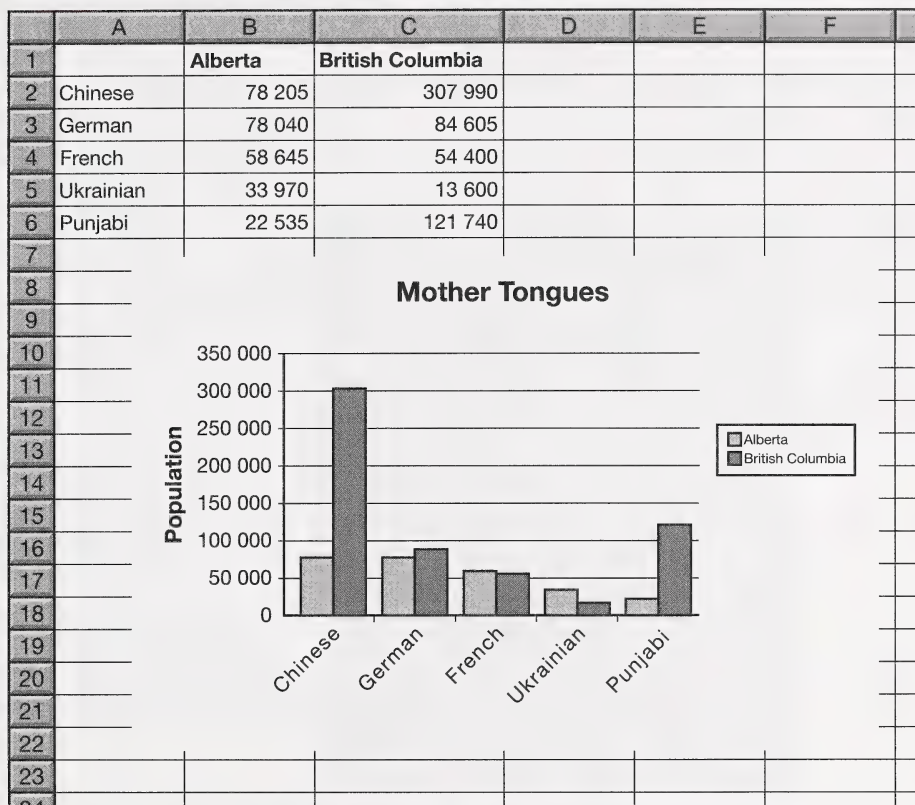
Category (X) Axis: No title is necessary.

Category (Y) Axis: Population

Then click on the Next button.



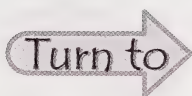
Step 8: Display the graph on your spreadsheet. Your graph should look like the one that follows.



- Turn to pages 295 to 298 in your textbook. Do questions 2 to 5 of "Put into Practice."

Check your answers on pages 55 to 58 in the Appendix.

In this lesson you explored how to present survey data. You discovered that data may be presented in words, tables, and graphs. You used the power of the spreadsheet to help create accurate and professional-looking graphs. You also analyzed survey results from graphs of data.



the Section 2 Assignment in Assignment Booklet 5B.
Answer question 1.

LESSON 2

Analyzing the Presentation of Data


In this lesson you will investigate the truthful presentation of data.



The British prime minister, Benjamin Disraeli (1804–1881), said, “There are three kind of lies: lies, damn lies, and statistics.”

Disraeli’s opinion about statistics is shared by many people who have seen statistics presented in a dishonest way to persuade or to deceive.

The ability to recognize when statistics are not presented honestly is a critical skill for all consumers and citizens.



If you have access to the Internet and would like to learn more about Benjamin Disraeli before you begin your investigation, you can access details of his life at the following website:

<http://www.lang.nagoya-u.ac.jp/~matsuoka/Disraeli.html>

You cannot believe everything that you read, see on television, or hear on the radio. You likely have seen examples of information that has not been presented fairly or accurately. In Section 1 you saw how data can be biased because of the sample used, the manner in which the survey was conducted, or the way the question was asked.

You must always examine claims that are based on polls carefully. How did the researchers gather their data. Whom did they survey? What questions were asked? What were their motives for conducting the survey?

Example

Read this newspaper article and comment on the claims that are made.

The headline may be inaccurate on several counts. Firstly, it is based on Dr. White's patients. They may not be representative of the entire teenaged population. Secondly, patients going to a dentist may be more likely to be having trouble with their teeth. And, thirdly, Dr. White did not comment on the nature of the cavities. The cavities may have been very minor. This is not a fair survey on the dental health of teenagers!

4 of 5 teenagers have poor teeth

SUZANNE BABIUK
Gazette Staff Writer
EDMONTON

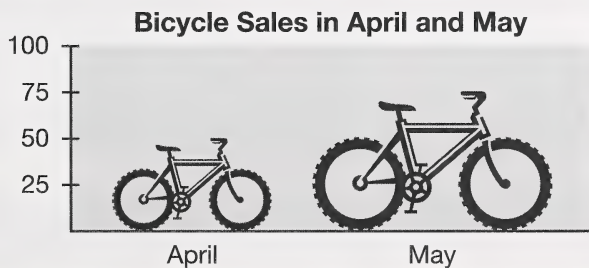
Dr. Pearl E. White, a dentist at the Oral Clinic, told this reporter in an interview yesterday, that of the 40 teenaged patients she saw last week 32 of them had to be treated for cavities.

Dr. White went on to say that she believes the main cause of our teenagers' poor oral health is no



Now it's your turn to comment on how data is presented.

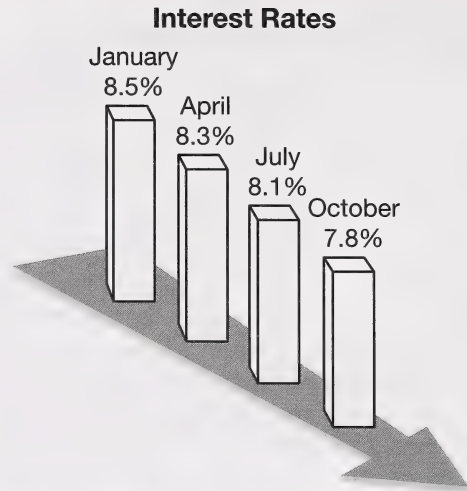
1. Dorothy was hired on May 1 at Cy's Cycle. At the end of May, she prepared a graph for the owner comparing bicycle sales in April and May.



- a. Does the graph present the data accurately? Explain your answer.
- b. What impression do you get when you look at the graph?
- c. How could the graph be improved?
- d. What was Dorothy's purpose for using the pictures of bicycles in the graph? Did she achieve her purpose?

2. A newspaper article about interest rates includes the graph shown to the right.

- Why is the graph misleading?
- Who might be presenting the data in this manner?
- How could you present the facts more honestly?



Check your answers on pages 58 and 59 in the Appendix.

As you discovered in questions 1 and 2, graphs can be used to deceive the reader. Next you will look at other ways that data may be distorted.



3. Turn to pages 299 and 300 in your textbook. Do questions 1 to 4 of “Investigation: Misleading Graphs.”

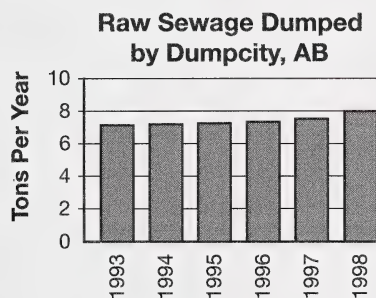
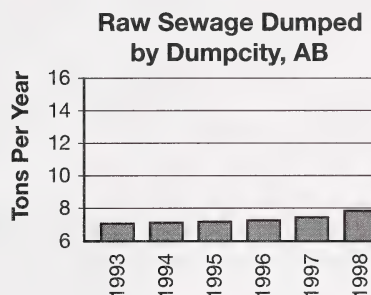
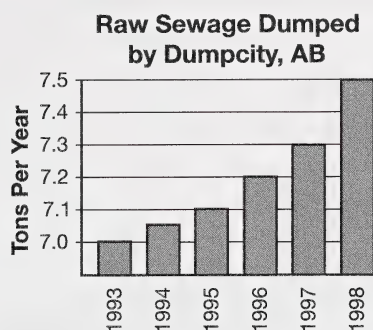
Check your answers on page 59 in the Appendix.

There are many ways of presenting data in a misleading manner. These include the following:

- incorrect scales
- stretched or compressed scales
- scales that do not begin at zero
- use of wider or narrower bars or pictures

Analyze the following graphs to discover how these graphs might have been designed to present a particular point of view.

4. The following three graphs present the same data.



- How do the graphs differ?
- What might be the motive of the designer of each graph?

5. Turn to pages 300 and 301 in the textbook. Study the example in the “closer look” box, and then do questions 1 and 2 of “Put into Practice.”

Check your answers on pages 59 and 60 in the Appendix.

In this lesson you explored ways data can be distorted to persuade or deceive. Look through newspapers and popular magazines to see if you can spot any of these techniques!

Turn to

the Section 2 Assignment in Assignment Booklet 5B. Answer questions 2 and 3.

CONCLUSION

In this section you used the power of graphs and tables to interpret, summarize, and present survey data. You used spreadsheet software to help you design graphs and tables. In addition, you explored how to present your data honestly and effectively. You examined graphs and charts that were flawed and did not present data in an open and straightforward way.



When you watch television, listen to the radio, pick up a newspaper, or read a magazine, you are presented with an array of facts and figures. Often this information is based on data collected through surveys. You must sort through this information and make informed judgments about its authenticity and accuracy. In the end, whether you are persuaded by the arguments of advertisers, government and politicians, or advocacy groups will depend on your skills at assessing the collection, presentation, and analysis of statistics. Having completed this section, you should be in a better position to make informed decisions.

MODULE SUMMARY

In this module you explored the gathering, presentation, and interpretation of statistical data.

In Section 1 you discussed how survey data is collected and how this data is affected by the nature of the sample, the sample size, the method of collection, and possible biases. Also, you explored issues that researchers must consider when collecting data, such as appropriate language, costs, privacy, and ethics. Depending on the data to be collected, you selected and defended appropriate data-collection techniques, such as questionnaires, interviews, and experiments.

In Section 2 you explored different ways of presenting data and analyzing results by focusing on the truthful display of statistics and the clarity of the presentation. You used spreadsheet software to display data in tables and graphs.



The survey techniques you explored in this module are used by the employees of Statistics Canada. Statistics Canada was created by an act of Parliament to collect data about Canada's people, economy, resources, and culture. Perhaps your future career will involve using information Statistics Canada gathers.



Assignment Booklet 5B and complete the Final Module Assignment.

REVIEW

This Review will help you apply what you learned in Module 5 and prepare for the Final Test. Read the skills checklist for this module. Use this list to guide your study and to help you decide how much of the Review you should complete.

Skills Checklist

Conducting a Survey

- ☐ Discuss how data are affected by the nature of the sample, the method of collection, the sample size, and biases.
- ☐ Describe issues to be considered when collecting data (for example, appropriate language, ethics, cost, privacy, and cultural sensitivity).
- ☐ Select, defend, and use appropriate methods of collecting data, such as
 - designing and using questionnaires
 - interviews
 - experiments
 - research

Presenting Data

- ☐ Read and interpret given data.
- ☐ Design different ways of presenting data and analyzing results by focusing on the truthful display of data and the clarity of presentation.
- ☐ Use a spreadsheet template to create graphs of survey data.
- ☐ Critique ways in which statistical information and conclusions are presented by the media and other sources.
- ☐ Draw and validate conclusions drawn from graphical and tabular data.

Review Questions

Turn to pages 302 to 305 in your textbook. Do questions 1 to 3 of “Review of Unit Five.”

Check your answers on pages 61 to 63 in the Appendix.



MATHEMATICS

24



Appendix

GLOSSARY

ANSWER KEY

IMAGE CREDITS

Glossary

biased: the description of a survey that is not valid or reliable; showing favouritism

closed questions: questions that force the respondent to make a choice

clustered sampling: a method of selecting a sample in which an entire subgroup is selected

For example, all the members of a certain class may be selected to participate in a school survey.

conjecture: a statement about the possible outcome of an experiment

convenience sampling: a method of selecting a sample in which the sample is chosen for the convenience of those conducting the survey

experiment: a means of obtaining information under specific, controlled conditions

open questions: questions that respondents answer in their own words

population: all the people or items about which a survey is conducted

random sampling: a method of selecting a sample in which each member of the population has an equal chance of being selected

reliable: a description of a survey that will yield the same or very similar results if repeated

sample: a part of the population

self-selected sampling: a method of selecting a sample in which those participating in the survey choose to become part of the sample

statistics: the branch of mathematics that deals with planning and conducting surveys and experiments to gather data, with analyzing and presenting the data, and the decision-making process based on the data

stratified sampling: a method of selecting a sample in which various groups within a population are fairly represented

survey: a means of obtaining data from a sample using interviews or questionnaires

valid: a description of a survey that actually measures what it sets out to measure

Answer Key

Section 1: Conducting a Survey

Lesson 1: Sampling Techniques

1. Convenience sampling may not provide the opinion of the entire school. Remember, convenience sampling is not random. Students do not have an equal chance of being surveyed. Selecting students by standing at the main entrance of the school and stopping them to ask their opinion may miss students. Students who are ill, arrive early or late, enter the building through a different entrance, or do not have a first-period class will likely be missed. Some students may be over-represented, such as those arriving at the front of the school by bus.

Self-selected sampling also may not be representative of school opinion. The students who go to pick up a questionnaire are likely to have strong opinions about the project.

2. Textbook, pages 279 and 280, “Put into Practice,” questions 1 to 4

1. Answers will vary. Sample answers are given.
 - a. **simple random sample:** At a local high school, the administration is studying a possible change to the school year. They decided to survey the opinions of 50 students. The names of all the students in the school were placed on separate slips of paper and placed in a box and mixed thoroughly. Then 50 names were drawn at random.
 - b. **cluster sample:** A large motel chain wishes to survey customer satisfaction. They decided to randomly select ten of their motels and survey all the customers staying at these motels next weekend.
 - c. **stratified sample:** A bank wishes to survey their customers about bank fees. The bank wants the sample to reflect the percentages of customers with different levels of income. For example, if 50% of their customers were in the \$40 000 to \$60 000 income range, they would want 50% of the customers sampled to fall into this category.
 - d. **self-selected sample:** A newspaper features a daily survey on their website. Today, they are asking if their readers approve of smoking in restaurants. Those readers who complete this survey form a self-selected sample.
 - e. **convenience sample:** An ice-cream store wishes to survey its customers about a new flavour of ice cream it plans to stock. Each customer who enters the store is given a sample of the new product and is asked for an opinion.

2. Answers may vary. Sample answers are given.

- a.** No, your class would not be a fair sample. The students in your class likely all come from the same community, may have a similar background, and may share similar interests. Your class probably would not represent Canadian teens in general.
- b.** If only sports-oriented families were surveyed, it is likely the results would indicate that teens are fit and healthy.
- c.** If you wanted to conduct a cluster sample, you could ask all the students in your class, grade, or school for their views.
- d.** For a stratified sample as part of a survey of Canadian teens, you should reflect the distribution of teens by gender, age, region, urban or rural residence, and place of birth.

3. Answers will vary. Sample answers are given.

- a.** The population for the survey is the entire student body of the school.
- b.** Enough students should be sampled to be representative of the school. The number will depend on the total enrolment. The higher the school population is, the more students you should select for your sample. Nevertheless, 50 students or so should be representative.
- c.** A stratified random sample should be selected to reflect the distribution of students by gender and grade.
- d.** You can select your stratified sample using numbered student lists by grade and a computer to generate random numbers to decide which students to select. Your sample should have the same proportions as the proportions of students by grade in your school.

4. Answers will vary. Sample answers are given.

- a.** No, a random sample of 100 students from your school is insufficient to generalize about Canadian youth. Your school is likely not diverse enough to reflect the complex make-up of all the country's young people.
- b.** No, a random sample of 100 students from your school is insufficient to generalize about youth in the province. For example, if your school is in a rural area with many students actively involved in farm work, your school's level of fitness may differ markedly from the level of fitness of urban students.

- c. A random sample of 100 students is sufficient to generalize about youth in the town, especially if all the town's youth attend the sample school.
- d. Yes, a random sample of 100 students is sufficient to generalize about the level of fitness of youth in the school. The smaller the school population is, the more reliable your survey results will be.

Lesson 2: Designing Questionnaires

1. Textbook, page 283, "Investigation: Looking at a Questionnaire"

The questionnaire is neither valid nor reliable. It is also biased. If the questionnaire was designed to survey the attitudes of all students about team sports, then the questionnaire should not have been administered to only a class of grade 10 girls. Boys and other grade levels should have been included as well. In addition, the questionnaire does not guarantee privacy for the respondents. Because of the lack of anonymity, respondents are less likely to answer honestly.

Question 1 is vague. It does not define what a "sports program" means.

Question 2 appeals to the respondents' emotions rather than reason.

Question 3 is unclear. It uses ambiguous and confusing language.

Both questions 4 and 5 are unclear. The language is confusing.

Question 6 does not take cultural or religious issues into account. Not everyone sets Saturdays aside for sports.

2. a. Textbook, pages 284 and 285, "Investigation 2: Looking at a Survey," questions 1 to 7

- 1. A total of 4369 adults and 1375 children aged 1 to 17 were questioned.
- 2. The Canadian Fitness and Lifestyles Research Institute conducted the survey.
- 3. The survey questions were not reported in the summary.
- 4. The questions were asked in the spring of 1999.
- 5. The sample selection process was not outlined in the report.
- 6. The sample was a random sample.

7. The information was collected through phone interviews. Parents responding on behalf of their children were all asked the same questions about their children's physical activities.

b. Textbook, pages 285 and 286, "Investigation 3: Looking at a Questionnaire"

The questionnaire is unlikely to be valid because fitness and health are not defined. As a result, respondents are not likely to be consistent in how they answer the questions. Nevertheless, respondents who answered "a" for each question are likely to be concerned about their level of fitness and to exercise regularly. Those who answered "d" very likely do not have a positive view of their own fitness.

3. Textbook, page 287, "Put into Practice," questions 1 and 3

Answers will vary. Sample answers are given.

1. Student answers will vary. A sample answer follows.

All responses to this survey will be held in confidence.

Use the following definitions for this survey.

- fit: A fit person can cover 1 km in 30 minutes or less.
- exercise: A 30-minute period of activity that raises the heart rate to 70% or more of its maximum safe level.

1. Give several reasons that people might not be fit by the survey's definition.

2. Using the given definition of exercise, how many days do you exercise each week?

A. 0–1 B. 2–3 C. 4–5 D. 6–7

3. Using the given definition of fitness, are you fit?

A. yes B. no

4. On the following 1 to 5 scale, mark your interest in being fit. 1 means totally uninterested, 2 means slightly uninterested, 3 is neutral, 4 is slightly interested, and 5 means extremely interested.

1 2 3 4 5

3. a. A questionnaire could be mailed to randomly selected households across the country. Residents over the age of 15 could be asked to answer the questionnaire and return the completed survey in a stamped, addressed envelope.
- b. The question is inappropriate. This question is not sensitive to people who, through no fault of their own, are in ill health. Also, the question incorrectly assumes that everyone's health can be improved through individual effort.
- c. This question is unclear. Health is not defined.
- d. This survey may be biased against those who already are actively trying to improve their health or who are ill through no fault of their own.
- e. A possible question follows:

What lifestyle measures are you taking or could you take to improve your level of fitness?

4. Answers may vary. Sample answers are given.

a. This question is better broken into two questions.

- Do you have a cat as a pet? Circle your response.

yes ☒ no

- Do you have a dog as a pet? Circle your response.

yes ☒ no

b. This question assumes that the respondent has a computer. As well, the word *happy* is not specific enough. Better questions may include the following:

- Do you own a computer? Circle your response.

yes ☒ no

- Does your computer meet your needs? Circle your response.

yes ☒ no

c. Since Alberta is in Western Canada, a resident of Alberta would have to choose both A and B. An open question, such as the following, may be more appropriate.

- Where do you live?

d. This question is worded to persuade the respondent to answer “Yes.” A better question follows.

- Are politicians compensated

A. too little B. about right C. too much D. don’t know

e. This question assumes that you have read the novel *The Leopard’s Pause*. It would be better to ask if the respondent has read this novel. If the respondent has read the novel, then ask the following question:

- How would you rate this novel?

A. outstanding C. average E. well below average
B. above average D. below average

5. Answers may vary. A sample answer is given.

The student council is collecting information from students about a proposal to have students, on a volunteer basis, plant trees in the town park.

1. If the tree planting were on Saturday, June 12, would you participate?

A. yes B. no C. don’t know

2. If the tree planting were on Sunday, June 13, would you participate?

A. yes B. no C. don’t know

Lesson 3: Interviews

1. Answers may vary. Sample answers are given.

Advantages

- An interview is more immediate than a written questionnaire. A written questionnaire may sit on the respondent’s desk for some time before it is completed and returned.
- An interview over the telephone is usually less costly than a face-to-face interview.

Disadvantages

- Face-to-face interviews may be difficult to arrange.
- Often people do not want to be bothered by telephone surveys.
- Respondents may not be honest when answering questions on a telephone survey.

2. Textbook, page 289, “Investigation: Interview Questions”

Question 1 is vague. It is better to ask, “Briefly describe the work you do.”

Question 2 assumes that people are able to brush their teeth three times a day. A better question is “Why do you think regular brushing is important for teens?”

Teeth whitening is not the same as dental hygiene. A better question is “Does using commercial whitening products improve a person’s dental health?”

Question 4 assumes three-month checkups are the rule. You should ask how often people should have a dental checkup, and to state their reasons for their choice.

Question 5 is too restrictive. There are other methods of oral hygiene besides flossing. Ask instead, “How often should teenagers floss their teeth?” and “Are there other things teenagers can do that have the same effect as flossing?”

Question 6 is a leading question. The question is really a statement about eating candy rather than a question about the foods people should avoid for good dental health. Ask instead, “Are there things teenagers eat that are bad for their teeth?”

3. Textbook, page 289, “Put into Practice,” question 1

1. Answers may vary. Sample answers are given.

a. Possible questions include the following:

i. Are you familiar with the physical education programs offered in schools?
Circle your response.

yes ☒ no ☐

If your answer is “Yes,” answer questions ii. and iii.

ii. What are the strengths of these programs?

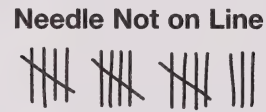
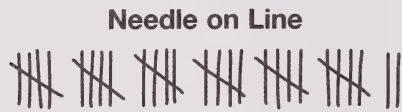
iii. How can these programs be improved?

b. The population could be restricted to school students or it could be expanded to include parents and other members of the community.

c. and d. Answers will depend on the population you sample, the sample size, and the survey questions.

Lesson 4: Experiments

Answers to the questions in this lesson will vary. Sample data is given below and is then used for the answers for questions 1 to 5.



1. The total number of times the needle landed on a line was 32.

$$\begin{aligned} 2. \quad \frac{\text{total number of tosses}}{\text{number of times the needle landed on a line}} &= \frac{50}{32} \\ &= 1.5625 \end{aligned}$$

3. $2 \times 1.5625 = 3.125$

4. The answer is close to the value of π , which is 3.141 59

5. You could increase the number of tosses to obtain a better approximation of π .

6. The average distance for a sample of 20 people is about 13 cm.

7. For $d = 13$ cm, t is about 0.16 s.

$$\begin{aligned} t &= \sqrt{0.002 \times 13} \\ &\doteq 0.161\,245 \end{aligned}$$

The average reaction time is about 0.16 s.

8. In most instances, the population would be students in your class, grade, or school.
9. If your intended population is people in general, your classmates would not be representative.
10. To ensure results are more reliable, select male and female subjects from a variety of age groups.
11. The reaction-time experiment involves selecting a representative sample of the population. The larger the sample, the more reliable your results will be.

The approximation-of- π experiment does not involve a sample. You simply drop the same needle repeatedly and record your results. The more trials you perform, the closer your experimental results will approximate π .

12. Textbook, pages 290 and 291, “Investigation: Heart Rate Experiment,” questions 1 to 6

- 1. to 6.** A strenuous exercise most of the class would be able to do is stepping up and down from the bottom stair of a staircase. Decide on a set period of time (perhaps 3 minutes) and on a set rate (perhaps 2 steps per second).

Take the subjects’ heart rates immediately before the exercise. These are their resting heart rates.

Immediately after the exercise, the participants’ heart rates will be elevated. The speed at which the heart rate drops to the resting rate is a measure of cardiovascular health. The heart rate recovers in two stages. The most rapid drop occurs in the first minute after exercise. After the first minute, the heart rate drops more slowly. The fitter individuals are, the more quickly their heart rates drop in the first minute and then return to the resting rate.

You can draw conclusions about the following:

- the average resting heart rate
- the average heart rate after exercise
- the average time to return to the resting heart rate

This experiment does not provide enough information to decide if the class is fit or not. Without a fixed standard to measure against, the fitness level cannot be determined. The only information found is how quickly the heart rates returned to normal. There are no standards to compare this with. There is only the vague statement that the heart rate of fit people return to normal soon after exercise. This leaves the question of “What is soon?”

13. Textbook, page 292, “Put into Practice,” question 1

- 1. a.** A test of suppleness involves the subjects’ sitting on the floor with their legs together straight out ahead of them. A metre-stick is held between their feet at the 50 cm mark. If you are testing the subject, press the subject’s legs flat against the floor. Ask the subject is to slowly reach forward as far as possible and to maintain that position for 5 seconds. Make sure the subject does not jerk forward and that the movement is smooth and gradual. Record the subject’s score as a positive distance beyond the toes or a negative distance from the toes.
- b. and c.** This exercise should not be presented as a competition among subjects, but simply as a measure of the suppleness of the subjects’ lower backs and hamstrings. Those conducting the tests should encourage each subject and no critical or judgmental comments should be made about performance. No one should be made to feel embarrassed. It is important to be sensitive to all disabilities.

- d. This test should not be too difficult for any of the participants. Although suppleness is a measure of fitness, performance on this test may also be based on the lengths of the subjects' arms and legs.
- e. Coaches, physical therapists, physical education teachers, and fitness counsellors could use this test to measure improvements in flexibility as a result of exercise and fitness programs.
- f. The phrase "fit enough" is not defined. The statement will mean different things to different readers.

Section 2: Presenting Data

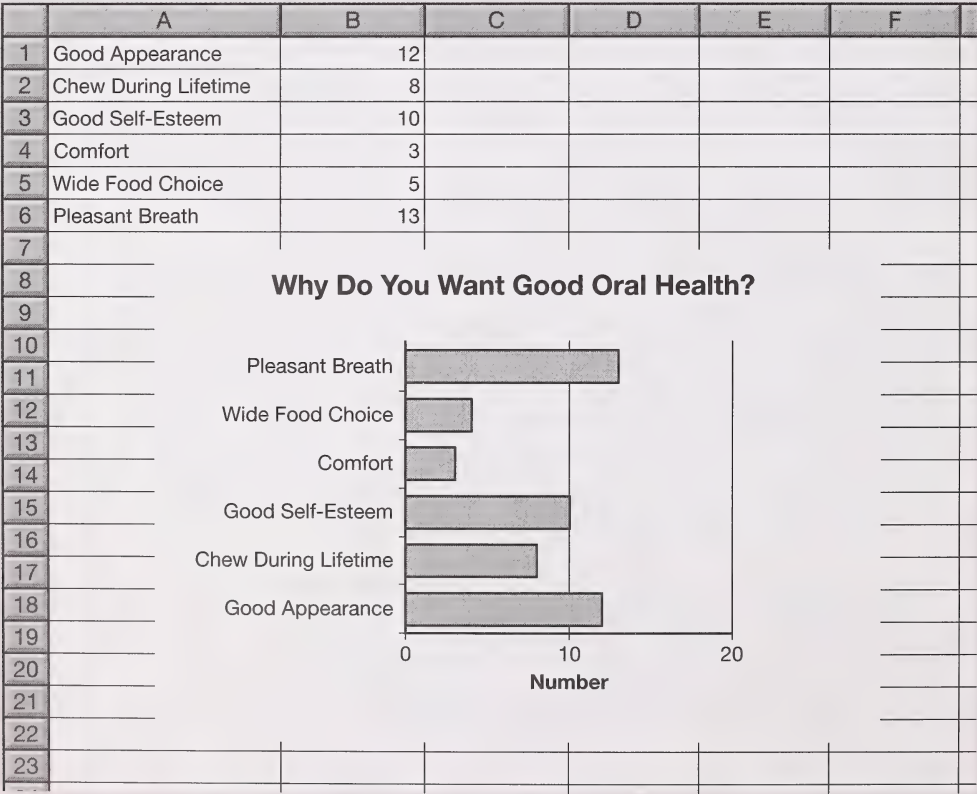
Lesson 1: Presenting Survey Results

1. Textbook, page 294, "Investigation: Looking at Graphs"

Answers will vary. Sample answers are given.

Use a spreadsheet to graph the data.

Your spreadsheet and graph should look similar to the sample shown below.



Three questions related to this graph follow:

- How many people were surveyed?

Answer: $12 + 8 + 10 + 3 + 5 + 13 = 51$

Fifty-one people were surveyed.

- What are the top two reasons people give for wanting good oral health?

Answer: The top two reasons are maintaining pleasant breath and a good appearance.

- What is the least popular reason people give for wanting good oral health?

Answer: The least popular reason given is comfort.

2. Textbook, pages 295 to 298, “Put into Practice,” questions 2 to 5

2. a. Teens appear to be less active than children aged 5 to 12 and have different interests. For example, teens do not often play on swings, slides, and teeter-totters. As children move into their teens, basketball becomes more popular and soccer less popular.

- b. For children aged 5 to 12, the most popular activities are playing on swings, slides, and teeter-totters; swimming; and bicycling. The least popular activities are playing basketball and running or jogging.

For teens, the most popular activities are swimming, bicycling, and walking. The least popular activities are playing soccer, running or jogging, and winter play, such as tobogganing.

- c. Your answers will depend on the area where you live and whether you live in an urban or rural area. Children in cities often have more access to organized sports than children in the country.

- d. Physical education teachers, recreational leaders, coaches, and health professionals could use this information.

- e. How close are your survey results to those presented in your textbook?

3. Answers will vary. Sample answers are given.

- a. The level of fitness drops as children get older.
- b. For each age group, subtract the percentages that are active from 100% to obtain the percentages that are not active enough for maximum health benefits.

For the 5 to 12 age group, 45% of the girls are active. Therefore, $100\% - 45\% = 55\%$ of the girls are not active enough for maximum health benefits.

For the 5 to 12 age group, 55% of the boys are active. Therefore, $100\% - 55\% = 45\%$ of the boys are not active enough for maximum health benefits.

For the 13 to 17 age group, 30% of the girls are active. Therefore, $100\% - 30\% = 70\%$ of the girls are not active enough for maximum health benefits.

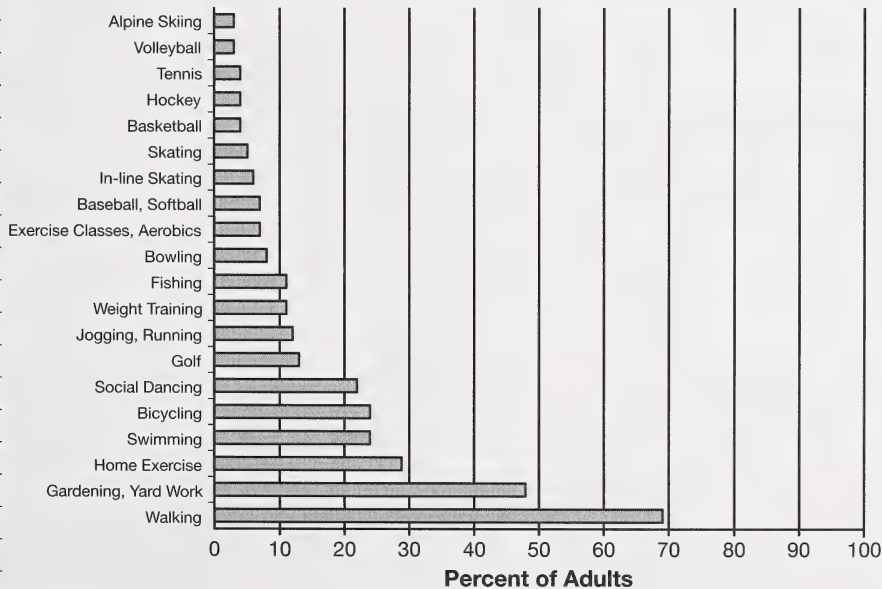
For the 13 to 17 age group, 40% of the boys are active. Therefore, $100\% - 40\% = 60\%$ of the boys are not active enough for maximum health benefits.

- c. Fewer girls may be engaged in strenuous exercise that fosters fitness and health.
- d. Your answers will depend on the area where you live.
- e. Difference in activity levels between boys and girls may be due to social and cultural factors. Society may not value strenuous activity for girls to the same extent as it does for boys.
- f. Physical education teachers, recreational leaders, coaches, and health professionals could use this information to design and promote activity programs for boys and girls.
- g. Physical activity is important for a feeling of well-being and for fitness, weight control, and general good health.

4. Use a spreadsheet program to graph the data.

	A	B	C	D	E	F
1	Walking	69				
2	Gardening, Yard Work	48				
3	Home Exercise	29				
4	Swimming	24				
5	Bicycling	24				
6	Social Dancing	22				
7	Golf	13				
8	Jogging, Running	12				
9	Weight Training	11				
10	Fishing	11				
11	Bowling	8				
12	Exercise Classes, Aerobics	7				
13	Baseball, Softball	7				
14	In-line Skating	6				
15	Skating	5				
16	Basketball	4				
17	Hockey	4				
18	Tennis	4				
19	Volleyball	3				
20	Alpine Skiing	3				

Popularity of Physical Activities Among Adults



- a. The participation in physical activity appears to be lower in the adult group than among children or teens. Walking is popular among all age groups, as are swimming and cycling. Several activities, such as tennis, bowling, golf, and social dancing, are listed only in the adult data.
- b. Answers will vary. Sample answers are given.

Differences occur among age groups because of social and cultural factors. Interests change as people grow older, and opportunities to carry out these interests change. Adults may cite family, job, and time restraints as reasons for their not exercising regularly or participating in team sports.

5. a. Add the numbers of bicycles in each row and then multiply by 2.

$$(6 + 5.5 + 2.5 + 4 + 2) \times 2 = 20 \times 2$$

$$= 40$$

Forty students answered the question.

- b. Yes, the results provide useful information. The results indicate that 28 out of the 40 students surveyed used an active mode, at least occasionally, to get to school. This represents $\frac{28}{40} = \frac{7}{10} = 70\%$ of those surveyed.
- c. Your answers will depend on your personal circumstances.
- d. Some reasons why schools and their students should participate in this event may include the following:
 - to increase awareness of walking as an alternative to riding to school
 - to promote a greater acceptance of walking as a mode of transport
 - to have students reflect on the benefits of walking

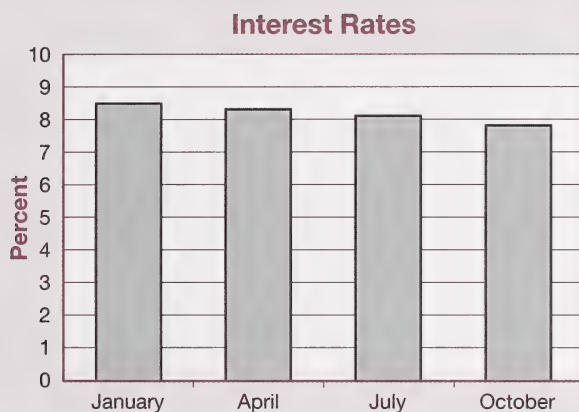
Lesson 2: Analyzing the Presentation of Data

1. a. The presentation of the data is not accurate. What part of the bicycle should the reader use to read the sales from the vertical scale? Should you use the seats, the handle bars, or perhaps the wheels? An accurate reading is difficult at best!
- b. When you first look at the graph, the larger bicycle creates the impression that sales have increased dramatically.
- c. The graph can be improved by using horizontal grid lines in order to read the values from the vertical scale more easily. Also, using bars instead of bicycles will go a long way to correcting the wrong impression the original graph created. In the original graph, the large bicycle appears much larger than the small bicycle, even though a careful reading of the graph will indicate only a small increase in sales.

d. Dorothy's purpose for drawing the original graph was to persuade the owner that sales skyrocketed after she was hired. Yes, Dorothy achieved her purpose.

2. a. The graph misleads because interest rates are not declining as quickly as the graph suggests. As a matter of fact, interest rates only fell 0.7% from January to October.
- b. Banks or lending institutions may be trying to persuade their customers that now is the time to take out a mortgage or personal loan.
- c. To present the data honestly, the bars should all be standing on a horizontal line, not a downward curved arrow.

A more honest graph is shown.



3. Textbook, pages 299 and 300, "Investigation: Misleading Graphs," questions 1 to 4

1. At first glance, the graph implies that inactivity increases markedly as people age.
2. The lowest value on the vertical scale is 40% instead of 0%. Setting the lowest value at 40% creates the impression that inactivity is almost 10 times as great in the 25 to 44 age group than in the 20 to 24 age group. In fact, inactivity only increased from 42% to 58% between these age groups.
3. It is important to use appropriate scales on graphs so that the numerical facts support the visual impressions.
4. People with an interest in promoting fitness may have produced the first graph to persuade older adults to exercise more.
4. a. These graphs have different vertical scales. The first graph uses a scale that starts at 6.9 and increases in steps of 0.1. The second graph uses a scale that starts at 6.0 and increases in steps of 2. The third graph uses a scale that starts at 0 and increases in steps of 2.

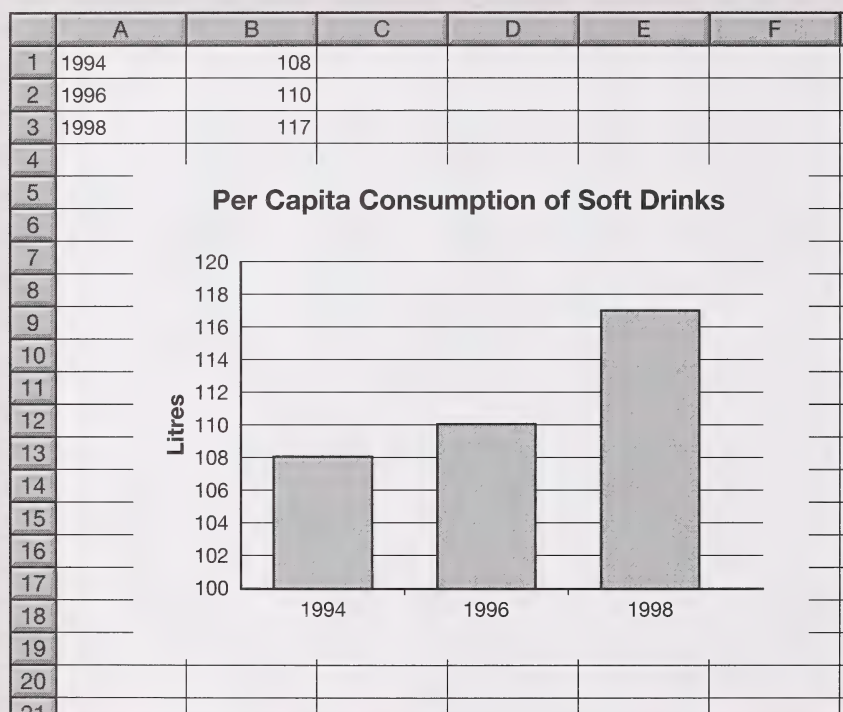
- b. The designers of the first graph may have wanted to create the impression that there has been a dramatic increase in the amounts of sewage dumped.

The designers of the second graph may have wanted to create the impression that there has been a small increase in the amounts of sewage dumped.

The designers of the third graph may have wanted to present the data honestly.

5. Textbook, page 301, "Put into Practice," questions 1 and 2

1. To suggest there has been a significant increase in the consumption of soft drinks, start the vertical scale of the graph at 100 L rather than 0 L. The following graph, produced by spreadsheet software, has this feature.



2. The problems with the graph include the following:

- no horizontal scale
- varying width of the bars
- no indication of the number of people surveyed
- no indication whether those surveyed gave a single response or multiple responses

Review

Textbook, pages 302 to 305, “Review of Unit Five,” questions 1 to 3

1. a. Add the number of choices from each category.

$$2 + 25 + 23 + 12 + 1 + 12 + 23 + 12 + 22 + 18 = 150$$

Divide the total number of choices by 5 because each student chose five foods they enjoy.

$$150 \div 5 = 30$$

There were 30 students in the survey.

- b. A food might not have been chosen because students did not like that food, it may be their sixth choice, or it may have been at the end of the list of foods and students might have made five other choices before they discovered it was on the list.
- c. to e. Answers will depend on your personal circumstances, the area where you live, the season of the year, what foods are readily available, and how expensive these foods are.

2. Answers will vary. Sample answers are given.

Possible questions on the survey include the following:

- 1. How many blocks do you live from school or work? Circle your response.
A. 1–3 B. 4–6 C. 7–9 D. 10 or more
- 2. How often do you walk to and from school or work? Circle your response.
A. every day B. 3–4 times C. 1–2 times D. seldom or not at all
- 3. Explain why you do or do not walk to and from school or work.
- 4. What are the benefits of walking to and from school or work?
- 5. What are the disadvantages of walking to and from school or work?
- a. and b. To choose your sample, you could randomly select telephone numbers from your local telephone directory and interview those who work or go to school. You may want a stratified sample to reflect the proportions of working people and school students in your community.

3. Answers will vary. Sample answers are given.

a. Your experiment should not put participants at risk.

b. i. You could do a telephone survey. You could use a computer to randomly generate numbers for your area. Explain the purpose of your survey to those answering their telephones and ask if they would be willing to participate. If they agree, record whether they are male or female.

ii. and iii. Possible survey questions include the following:

1. On an average day, how many cans of soft drink do you consume?
A typical can of soft drink is about 300 mL. If you drink bottled soft drinks or soft drinks from a dispenser, estimate the equivalent in cans. Circle your response.

A. 0 ~~1-2~~ B. 1-2 ~~3-4~~ C. 3-4 ~~5 or more~~ D. 5 or more

2. What is your age? Circle your response.

A. younger than 12 B. 12-19 C. 20 or older

c. i. This question is invalid. Consumption is not directly related to a person's favourite soft drink.

ii. This question is invalid. "A lot of soft drinks" is not defined.

iii. This question is invalid. The intent of the survey is to determine an individual's consumption, not a family's consumption.

iv. This question is invalid. Opinions about others' consumption are not being investigated.

v. This question is invalid. Prices of soft drinks vary. You cannot determine consumption from the amount spent alone.

d. i. From the three graphs, you can conclude that the consumption of milk has declined, the production of soft drinks has increased, and teens' consumption of soft drinks has increased. Also, boys drink more milk and soft drinks than girls. Single-serving containers have been increasing in size.

ii. Soft-drink production is increasing. Soft-drink consumption is increasing among both teen boys and girls. Milk consumption is decreasing among both teen boys and girls. Single-serving containers have been increasing in size.

- iii. For the “Growing Size of Single-Serving Containers” graph, the percents on the vertical axis do not make any sense. Furthermore, there is no label on the vertical axis. Using bottles rather than bars of equal width creates the impression that container size has increased several times over.

For the graph comparing boys’ and girls’ soft-drink consumption, there is no label on the vertical axis.

The “Annual Soft Drink Production” graph is misleading because there is no label on the vertical axis and the vertical axis begins at 50 rather than at 0.

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Multimedia

The following multimedia segment for Module 5 appears on the multimedia CD:

- “Making Graphs with a Spreadsheet”

